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CONCRETE BATCH PLANT EVALUATION

OSAN AIR BASE, KOREA

OCTOBER 1981

**OL-AD
USAF OCCUPATIONAL
and
ENVIRONMENTAL HEALTH LABORATORY**

AEROSPACE MEDICAL DIVISION (AFSC)

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**CLARK AIR BASE
REPUBLIC OF THE PHILIPPINES
APO SAN FRANCISCO 96274**

REPORT NO. 81-40

CONCRETE BATCH PLANT EVALUATION
OSAN AIR BASE, KOREA

OCTOBER 1981

SURVEYED AND PREPARED BY:



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I. INTRODUCTION

During the period 5-9 Oct 81, personnel from OL AD, USAF OEHL, Clark AB, Republic of the Philippines, performed an evaluation of the 554th CESHHR concrete Batch Mixing Plant at Osan AB, Republic of Korea. This evaluation was requested by USAF Hospital Osan/SGPM on 15 Jun 81 and by HQ PACAF/SGPE on 13 Jul 81. The purpose of the evaluation was to document the degree of exposure, evaluate the respiratory protection, and evaluate the feasibility of engineering controls.

II. PERSONNEL

The survey was performed by Lt Col Edwin C. Banner III and SSgt George A. Lafferty, Jr., of OL AD. The following personnel were contacted at Osan:

Maj Thomas Eikerenkotter, Operations Officer, 554th CESHHR
Capt John J. Shirtz, Bioenvironmental Engineer, Osan AB
TSgt Fred Koethe, NCOIC, Bioenvironmental Engineering Svc
SSgt Colon, NCOIC, Batch Plant, 554th CESHHR

III. METHODOLOGY AND EQUIPMENT

The exposure consist of cement dust. The samples were taken utilizing Millipore matched weight filter cassettes with the face open. Air flow was provided by DuPont P-2500 Constant Flow Pumps calibrated at 1.5 liters per minute. The pumps were calibrated utilizing the bubble tube technique as recommended by NIOSH analytical methods before and after each day's activity. After the first days of calibration, the pumps did not require recalibration.

As the name implies the Batch Plant mixes a truckload of concrete at a time. For this reason, the personal sampling was done on a per truck basis the first day. The second day all employees, except the Hell-Hole worker, were sampled on a two-truck basis. This was done to conserve filters and to get a better weight differential.

IV. OPERATION

The operation consists of mixing fifty-one (51) bags of cement with the appropriate weight of sand, gravel, and water to mix six (6) cubic yards of concrete in a concrete truck. At the present time bags of cement are slide down a chute, ripped open, and deposited on a grating above a hopper (Fig 1). One employee must stand on this grating, dump the bags, and throw them to one side. This is fondly called the Hell-Hole.



Fig 1.

The employee in the Hell-Hole is protected by coveralls, gloves, boots, scarf, and full-face respirator, MSA ultra-twin (Fig 2).



Fig 2.

The cement is collected in the hopper (Fig 3),

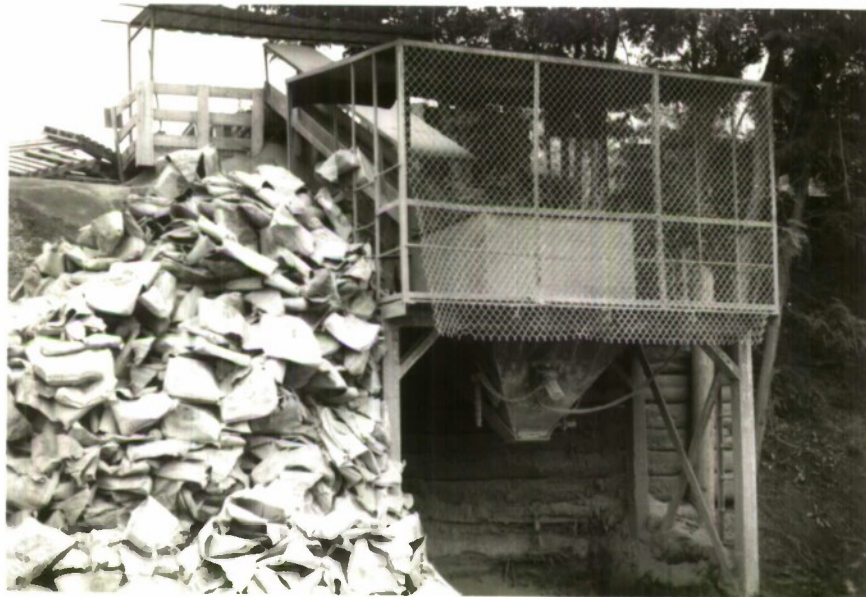


Fig 3.

dumped into a front end loader (Fig 4),



Fig 4.

and transported approximately 150' to the scale hopper and dumped (Fig 5).



Fig 5.

Sand and gravel are also loaded into the scaled hoppers and added to the truck by weight.

The greatest exposures occur to the Hell-Hole operator, the employee at the top of the scale hopper, and the scale operator. Secondary exposures occur to the two (2) employees who place the bagged cement on the chute, and the driver of the front end loader.

All of these employees were sampled during the operation. The results were compared to the Permissible Exposure Limits (PEL) given in AFOSH Standard 161-8 "Permissible Exposure Limits for Chemical Substances." Paragraph C1 states "The American Conference of Governmental Industrial Hygienist (ACGIH) updates their TLV publication annually. When changes occur, the most recent values must be used." TLV list for 1981 was used for this report.

V. RESULTS AND DISCUSSION

The results of the sampling are given in Table I. The complete data is included as Appendix 1.

TABLE I.

<u>Sample No.</u>	<u>Time (Min)</u>	<u>Conc (Mg/m³)</u>	<u>Operation</u>
1	9	*	Hell-Hole (HH)
2	13	20.5	Bag Dropper
3	12	38.9	Bag Dropper
4	72	13	Front End Loader
5	58	5.7	Scales
6	16	375	HH
7	14	23.8	Bag Dropper
8	14	9.5	Bag Dropper
9	8	508	HH
10	8	25	Bag Dropper
11	7	9.5	Bag Dropper
12	13	661.5	HH
13	20	110.0	Bag Dropper
14	165	26.7	Front End Loader
15	268	4.7	Scale Hopper
16	270	11.1	Scale Operator
17	5	1693.3	HH
18	114	62.5	HH
19	71	26.3	HH
20	16	437.5	HH
21	10	486.7	HH
22	13	933.3	HH

* Sample #1 was mishandled during removal and was considered invalid.

As can be seen, the operator in the Hell-Hole has the maximum exposure averaging 576 mg/m^3 for each truckload mixed; the average truck takes less than 15 minutes to complete. Samples #18 ($T = 114 \text{ min}$) and #19 ($T = 71 \text{ min}$) were not usual due to the concrete trucks being delayed. Omitting these two samples, the average concentration is 728 mg/m^3 .

The workload factors at the Batch Plant are inconsistent, as would be expected, ranging from no trucks to a high of twenty-two (22) truckloads in one day. The employees do rotate the Hell-Hole operation among themselves, thereby, decreasing the overall exposure. There was not a significant exposure differential between employees, indicating no work practices that could be improved to lessen exposure.

The current workload, work practices, type of respirator, and respirator protection factors for these respirators indicates that the employees inhalation exposure is not exceeding the PEL.

Portland Cement is classified as a nuisance dust by ACGIH, with an assigned TLV (PEL) of 10 mg/m^3 , total dust (1981). The normal physiological response to Portland Cement is irritation to the skin and upper respiratory tract due to the alkaline action of cement. The irritation to the upper respiratory tract will be severe enough to terminate exposure before irreversible damage takes place. Skin irritation and possible dermatitis are the primary concern.

Since the cement was made in Korea, a chemical analysis was performed to determine if any trace contaminants, metals, or salts were present. None were present; data in Appendix 2.

VI. RECOMMENDATIONS

The present Batch Plant at Osan defies engineering methods to decrease the exposure to the Hell-Hole operator. The bag splitting and dumping operation should be replaced by an automatic cement dispenser, silo, which would do away with the bag splitting and dumping operation. This option is currently being pursued by 554th CESHR personnel.

Until this is accomplished, the following physical and operational modifications should be made to lessen the exposures:

1. Enclose the air gap between the scale hopper and the trucks. Any time granulated material or powder falls or is disturbed, dust is generated. Enclosing this air gap will decrease the exposure to the scale operator and may result in a small savings of cement.

2. Improve sanitary facilities at the Batch Plant. The current toilet and washing facility is on the second level. This facility is not functioning correctly at this time. Given the irritating nature of cement, personnel should be encouraged to wash

frequently. The existing washroom does not encourage this. The washroom facility should be relocated to the upper level where the primary exposure occurs (AFOSH Std 161-8).

3. Improve the respiratory fitting program. Although the respirators seem adequate, there is no documentation of a fit test program and the employees seem uneasy about the protection afforded by the respirators. An education and testing program in accordance with AFOSH Std 161-1 should be instituted.

APPENDIX 1

BATCH MIXING PLANT OSAN AB 7-8 OCT 81

Sample No.	Operator	Job	Time Off	Time On	WT (MG)	[C] Mg/M ³
1	Mr Ku, Mi Sil	Hell-Hole	0815	0806	*	
2	Mr Chong, Yong Hwan	Bag Dropper	0812	0759	0.4	20.5
3	Mr Choe, Pyong Min	Bag Dropper	0813	0800	0.7	38.9
4	Mr Yi, U. Yol	Driver, Front End Loader	0907	0748	1.4	13.0
5	Sgt Millin	Scale Operator	0852	0754	.5	5.7
6	Mr Ku	Hell-Hole	0834	0818	9.0	375
7	Mr Chong	Bag Dropper	0827	0813	.5	23.8
8	Mr Choe	Bag Dropper	0827	0813	.2	9.5
9	Mr Ku	Hell-Hole	0851	0843	6.1	508
10	Mr Chong	Bag Dropper	0845	0837	.3	25
11	Mr Choe	Bag Dropper	0845	0838	.1	9.5
12	Mr Chong	Hell-Hole	0941	0928	12.9	661.5
13	Mr Choe	Bag Dropper	0946	0926	3.3	110
14	Amn Reed	Driver F-E Loader	1145	0900	6.6	26.7
15	Mr Yi	Scales Hopper	1318	0850	1.9	4.7
16	Sgt Millin	Scale Operator	1318	0848	4.5	11.1
17	Mr Chong	Hell-Hole	0943	0937	12.7	1693.3
18	Mr Chong	Hell-Hole	1101	0950	10.7	62.5

* Sample #1 was mishandled during removal and was considered invalid.

OSAN AB 7-8 OCT 81 (CONT'D)

[illegible]

APPENDIX 2

		mg/l concentrated digested solution	%	Concrete Bulk Sample						500 mg Sample 100 ml digested solution		
Sodium		1.1	0.02									
Potassium		45.5	0.91									
Calcium		1863	37.26									
(as Calcium Oxide)		2608	52.16									
Magnesium		97.5	1.95									
Iron		134.7	2.69									
Manganese		5.3	0.11									
Lead		0.7	0.01									
Copper		0.41	0.08									
Zinc		1.19	0.02									
Chromium +6		0.48	0.01									
Silver		<0.01	<.01									
Cadmium		0.02	<.01									
Nickel		0.27	.01									
(as Ca CO ₃)		4658	93.2									

Perkins-Elmer HCL Digestion Method for Concrete

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